

A COMPARISON STUDY OF HYDROGEN INCORPORATION IN DIAMOND: EFFECT OF CRYSTALLINE STATE AND ORIGIN OF DIAMOND

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Abstract

Hydrogen is a very important impurity for semiconductor science and technology. It is well known that hydrogen is inevitably incorporated into CVD diamond during the growth process [1,2], due to rich hydrogen in the growth atmosphere. By controlling the growth conditions, diamond of different crystalline state ranging from single crystalline, polycrystalline through microcrystalline to nanocrystalline have been obtained, and correspondingly the size of the grains which compose these films decreases rapidly. In order to identify the origin and forms of hydrogen incorporated in CVD diamond, we present this review-like work. In this work a comparison study of hydrogen incorporation in diamond is primarily performed by three ways, i.e. in terms of crystalline state of diamond, origin of diamond and type of carbon. Among different types of CVD diamond films in terms of crystalline state, the effect of grain size on hydrogen incorporation is also discussed. Considering the origin and growth technique of diamond, hydrogen incorporation among natural diamond, high-pressure high-temperature (HPHT) synthetic diamond and CVD diamond is investigated. In terms of type of carbon, hydrogen incorporation in diamond and non-diamond such as diamond-like carbon (DLC) film and hydrogen terminated amorphous carbon (α -C:H) film is briefly discussed. In the end, based on our work and those in the literature, a summary including concluding remarks on hydrogen incorporation in diamond is presented.

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